Cumulus Photogrammetric, In-situ and Doppler Observations (CuPIDO)

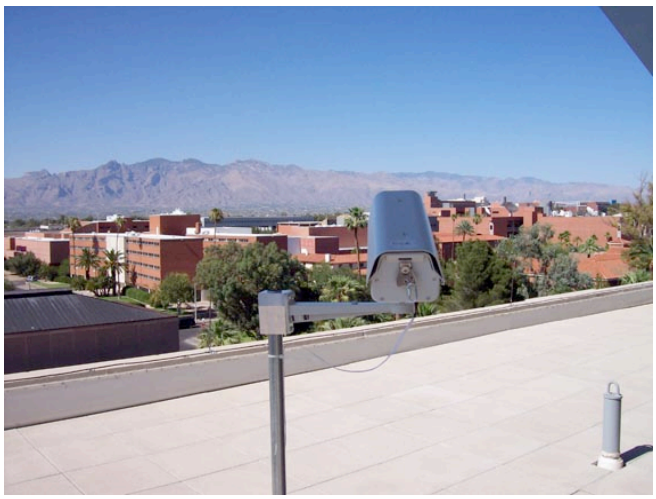
A field experiment to study the onset and development of summer monsoon thunderstorms will be held during July and August of 2006 over the Santa Catalina Mountains near Tucson, AZ. CuPIDO (Cumulus Photogrammetric, In-situ and Doppler Observations) will consist of coordinated observations using pairs of stereo cameras, a network of surface weather stations, GPS based vertical sounding systems and an instrumented aircraft.

Summer thunderstorms over the mountains in the desert southwest build slowly and in stages in spite typically unstable conditions. The "sky islands" of the desert southwest serve as a natural laboratory for the study of cumulus clouds owing to the development in a fixed location under the influence of surface heating and moisture transport. The objective of CuPIDO is to characterize the onset and transition from shallow to deep convection under differing environmental conditions using surface and upper air measurements, airborne Doppler radar observations and stereo digital photogrammetric techniques.

The central hypothesis of CuPIDO is that deep convection and thunderstorm development only occur once the air over the mountains is sufficiently moistened by shallow convection to prevent evaporation of the clouds by entraining drier surrounding air. Testing this hypothesis requires detailed

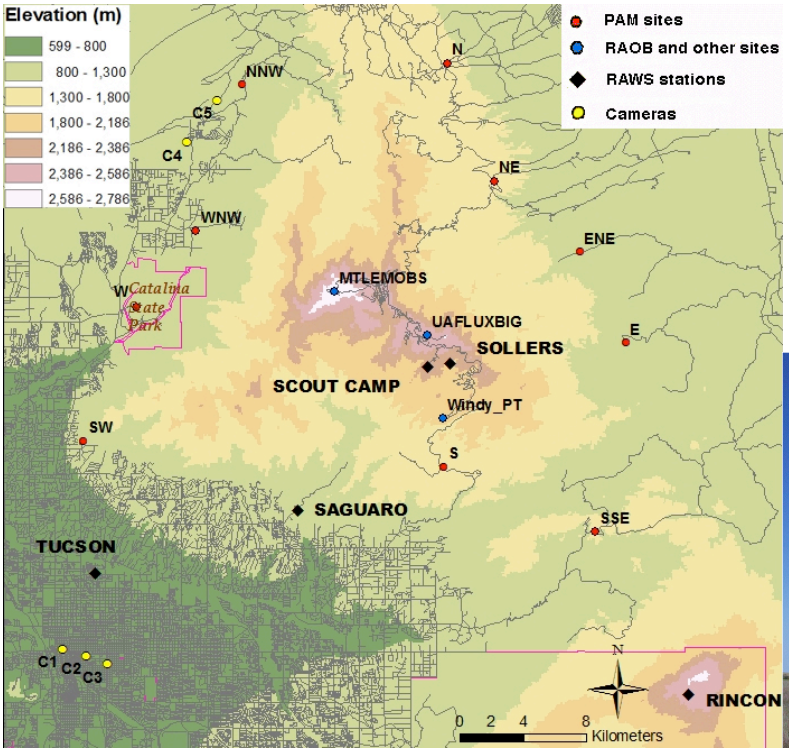
monitoring of changes in the temperature and moisture in the near surface air above the mountain, as well as conditions aloft.

The CuPIDO field experiment will employ an array of ground based and airborne observing platforms. These include pairs of digital cameras that will be located near the base of the mountains.

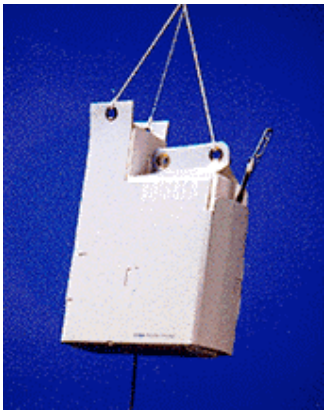


Automatic image processing techniques allow us to determine the structure of the clouds and monitor their changes with time.

A network of 10 surface weather stations (PAM-III) will be located around the base of the mountain. Four of the stations will be equipped with additional sensors that will allow monitoring of surface heat and moisture transport in addition to meteorological conditions.



The surface stations will be located around the base of the mountain in order to measure the upslope transport of warm and moist air. Conditions at the top of the mountain are monitored by a 30 meter tower located at the top of Mt Bigelow and operated by the University of Arizona.



Changes to the moisture and temperature above the mountain will be monitored using two mobile balloon based sounding systems. These systems use instrument packages which measure temperature and moisture. The position is tracked using the Global Positioning System (GPS) to determine winds aloft.

Further details on conditions above the mountain, as well as the internal structure of the clouds will be the obtained using the University of Wyoming King Air with the 95GHz (W-band) Wyoming Cloud Radar (WCR). The WCR is capable of 30 meter resolution and hence will reveal details of the circulation within and surrounding the cloud

Data collected during CuPIDO will increase our understanding of the onset and development of summer thunderstorms in Arizona. Given the fixed location of the cloud formation, we

sample conditions before the convection begins and study the earliest stages of development. The information we gain from this study will help severe storm forecasters and improve the performance of short range weather forecast models and longer range climate models.

CuPIDO will include participation by personnel from the Arizona State University, the University of Arizona, University of Wyoming, National Center for Atmospheric Research, University of Miami and the University of Alabama, Huntsville.

Additional details on the project may be found at the CuPIDO project web page

http://geography.asu.edu/zehnder/cupido/

Information on the cloud photogrammetric analysis may obtained through the ASU Partnership for Research in Spatial Modeling (PRISM)

http://prism.asu.edu/clouds/

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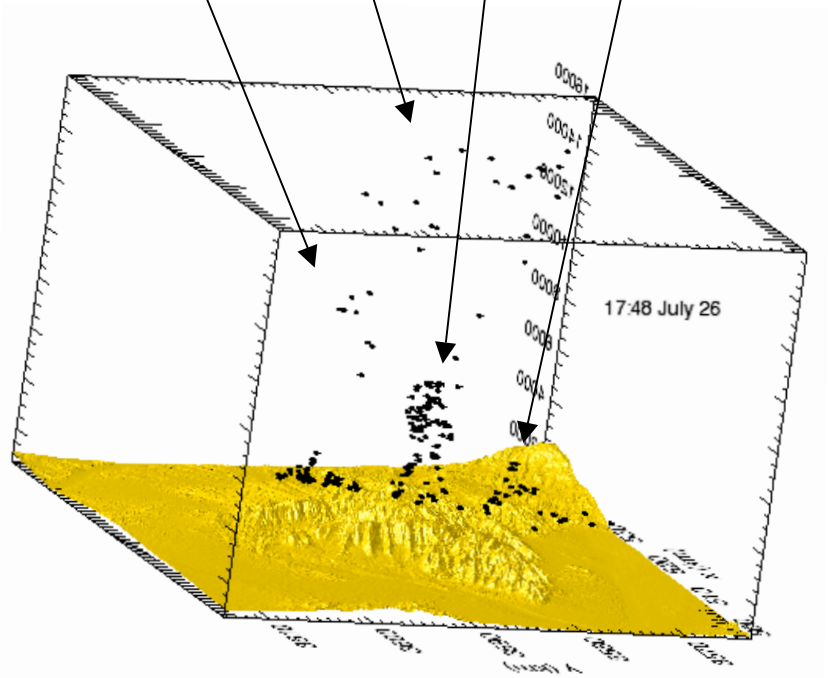

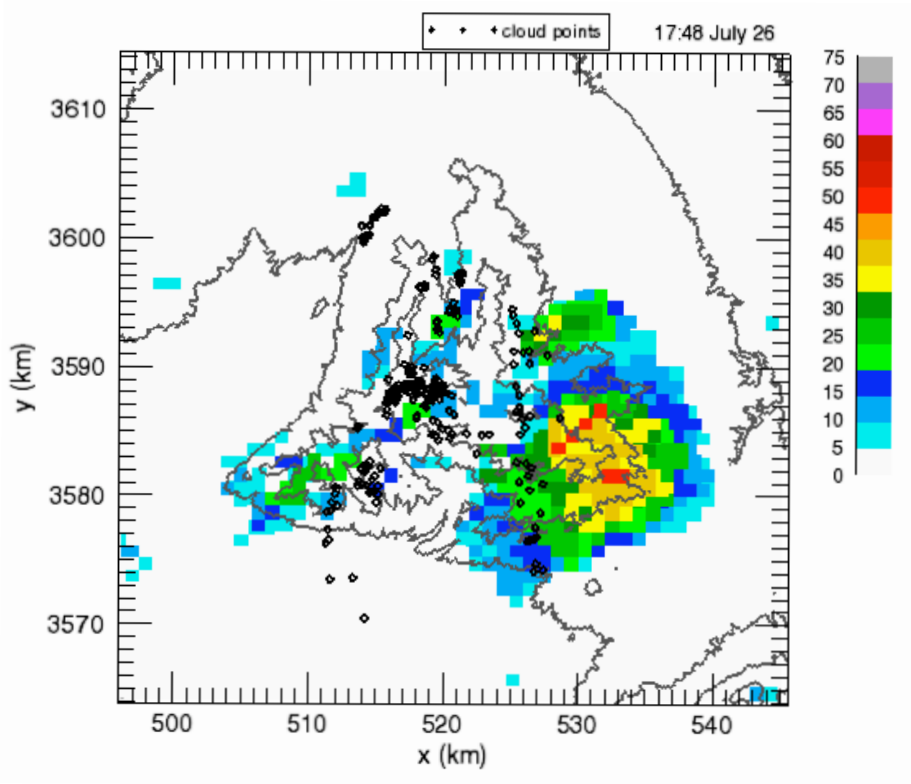

Three-dimensional cloud reconstructions from stereo pair of cameras (left). Comparison of Tucson WSR-88D radar with cloud points from cameras (above)